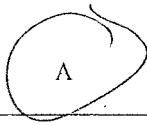


# REPORT DOCUMENTATION PAGE

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OMB No. 0704-0188

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1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)		
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			5b. GRANT NUMBER	
			5c. PROGRAM ELEMENT NUMBER	
			5d. PROJECT NUMBER	2302
			5e. TASK NUMBER	MIG2
			5f. WORK UNIT NUMBER	346120
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Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048				
10. SPONSOR/MONITOR'S ACRONYM(S)				
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12. DISTRIBUTION / AVAILABILITY STATEMENT				
Approved for public release; distribution unlimited.				
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14. ABSTRACT				
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15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES
				
a. REPORT	b. ABSTRACT	c. THIS PAGE		
Unclassified	Unclassified	Unclassified	19a. NAME OF RESPONSIBLE PERSON	Leilani Richardson
19b. TELEPHONE NUMBER (include area code)	(661) 275-5015			

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

22 May 2002

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2002-128**  
C.T. Liu (PRSM), "Investigating the Effects of Specimen Thickness and Pressure on the Crack Growth Behavior of a Particulate Composite Material"

**ASME Winter Meeting** (Statement A)  
(**Blacksburg, VA, 24-28 June 2002**) (**Deadline = 19 June 2002**)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

**Comments:**

Signature \_\_\_\_\_ Date \_\_\_\_\_

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

### Comments:

Signature \_\_\_\_\_ Date \_\_\_\_\_

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b) appropriateness of references, if applicable; and c.) format and completion of meeting clearance form if required

Page 1 of 1

Signature \_\_\_\_\_ Date \_\_\_\_\_

4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments:

APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL

### Technical Advisor

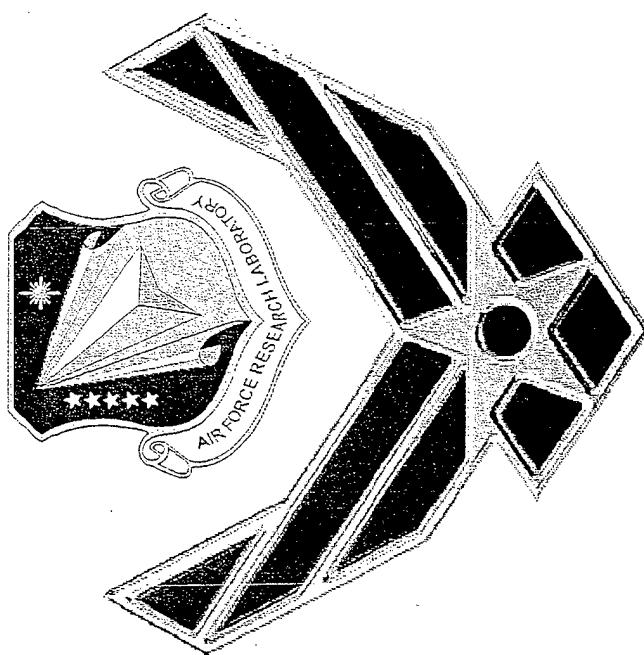
## Space and Missile Propulsion Division

# Investigating the Effects of Specimen Thickness and Pressure on the Crack Growth Behavior of a Particulate Composite Material

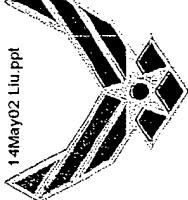
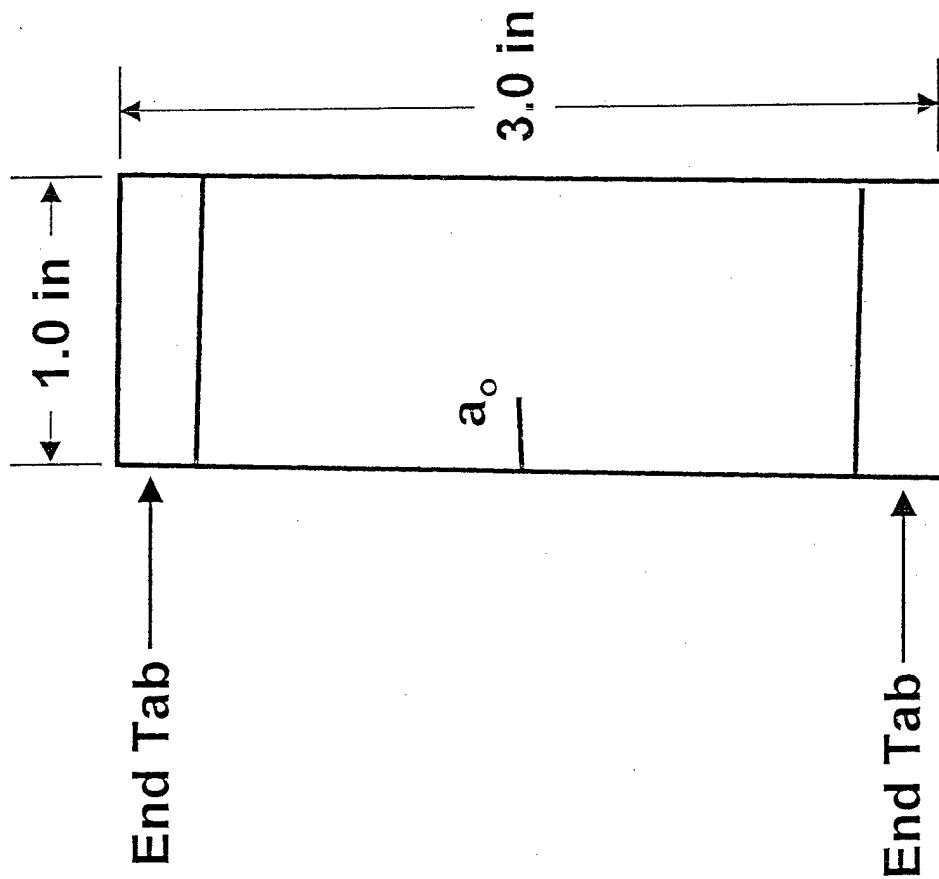
C. T. Liu  
Principal Research Engineer

PRSM

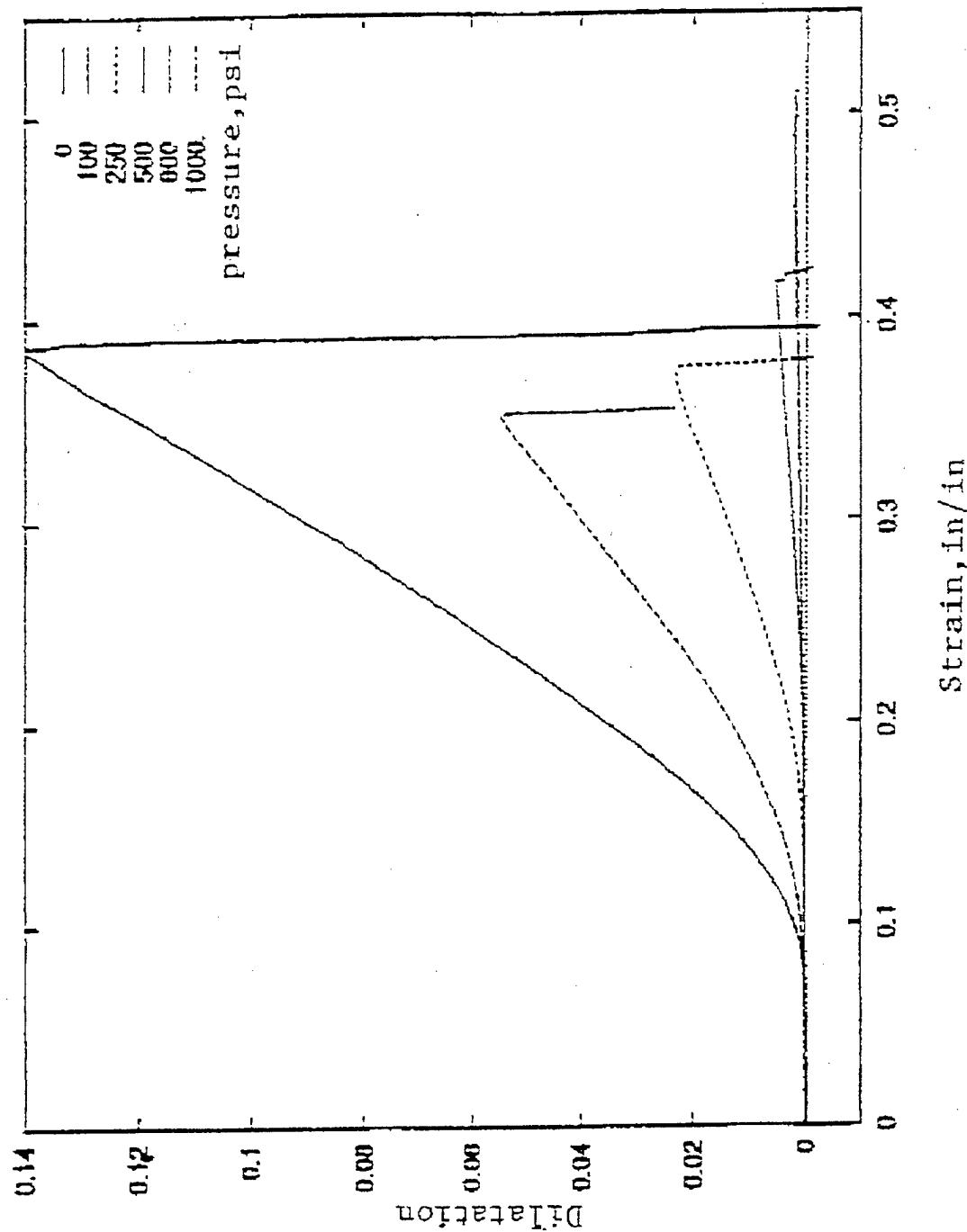
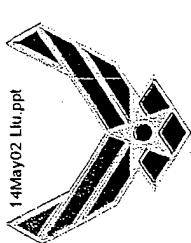
Air Force Research Laboratory



# Specimen Geometry

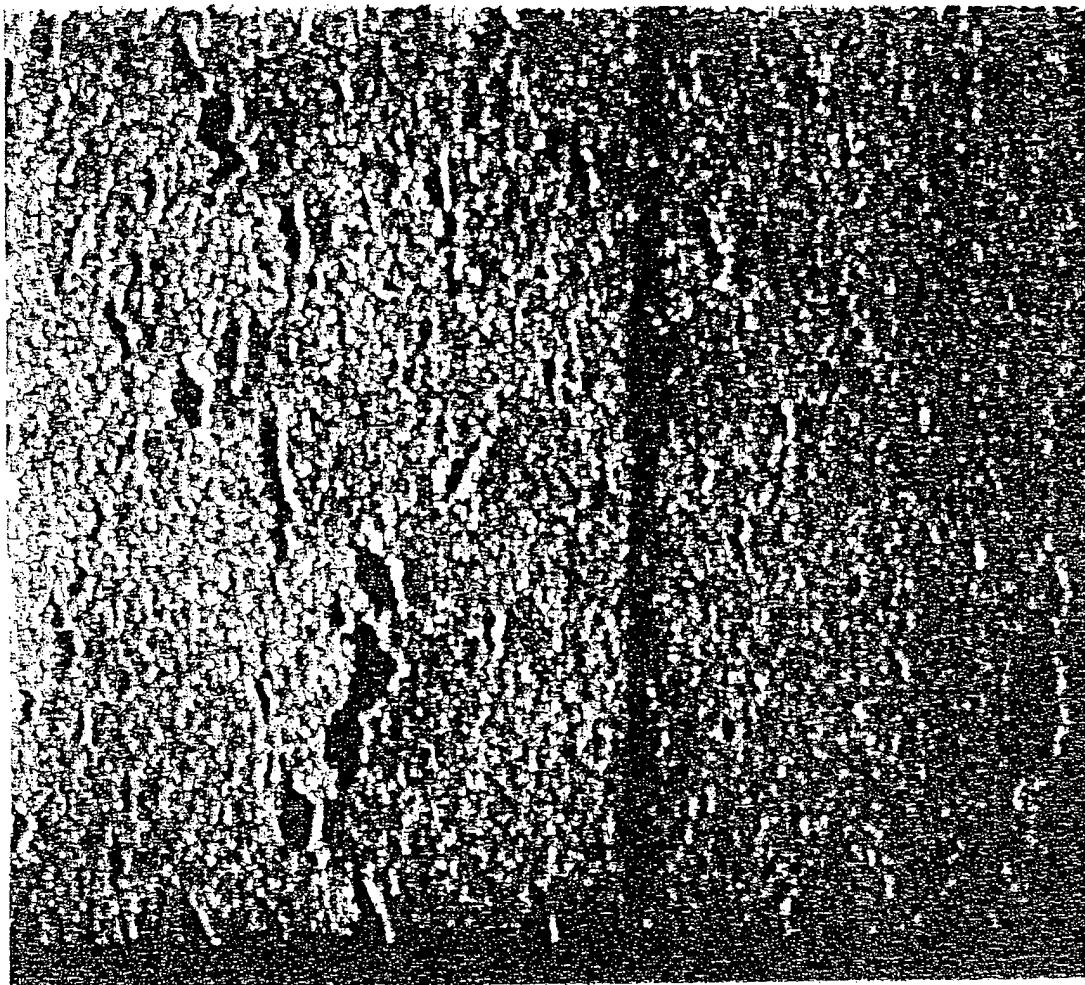
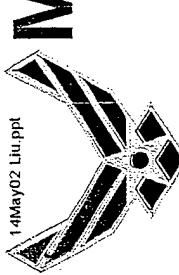


# Volume Dilatation vs. Pressure



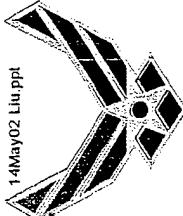


## Microcracks in the Specimen under Pressure

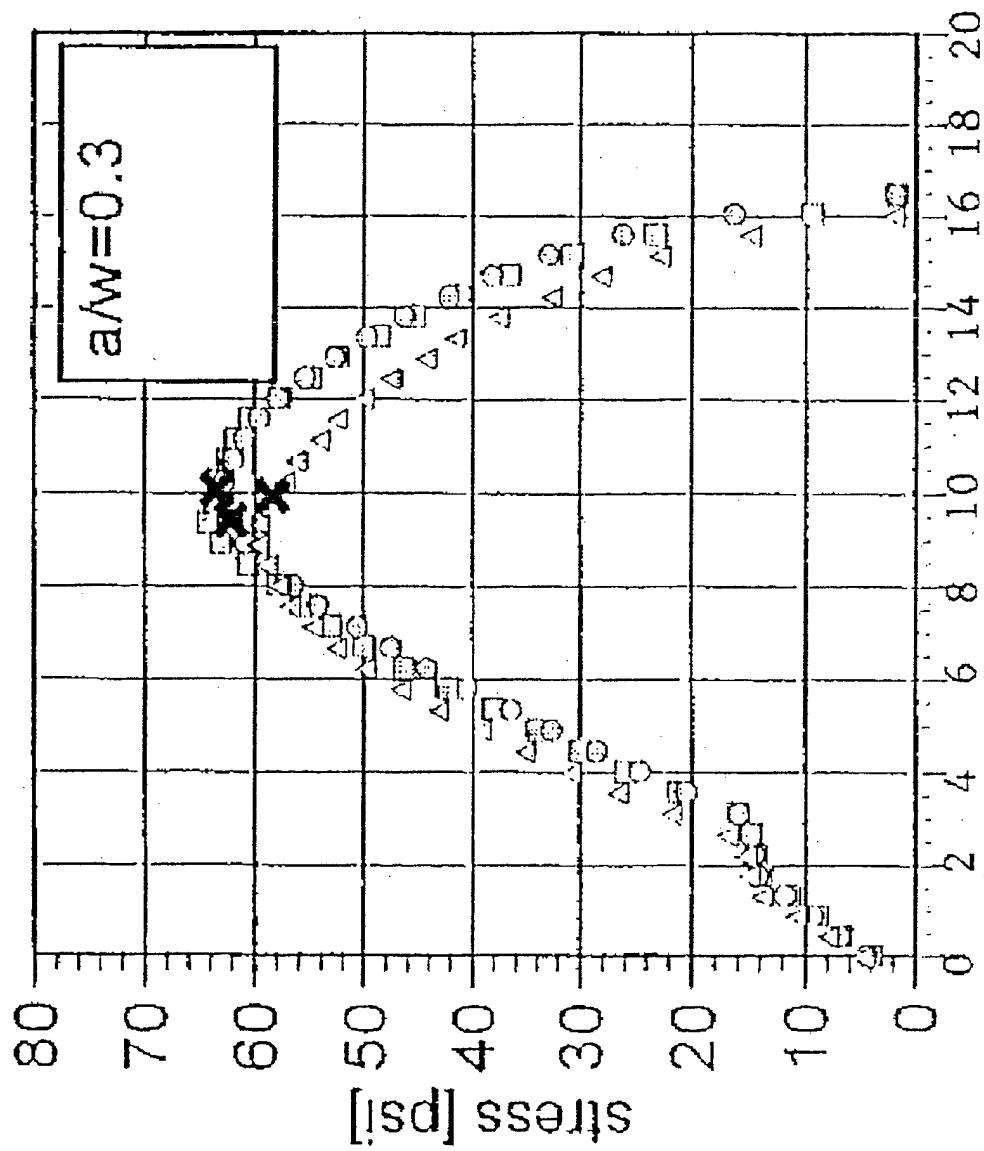




# Stress-Strain Curves under Ambient Pressure



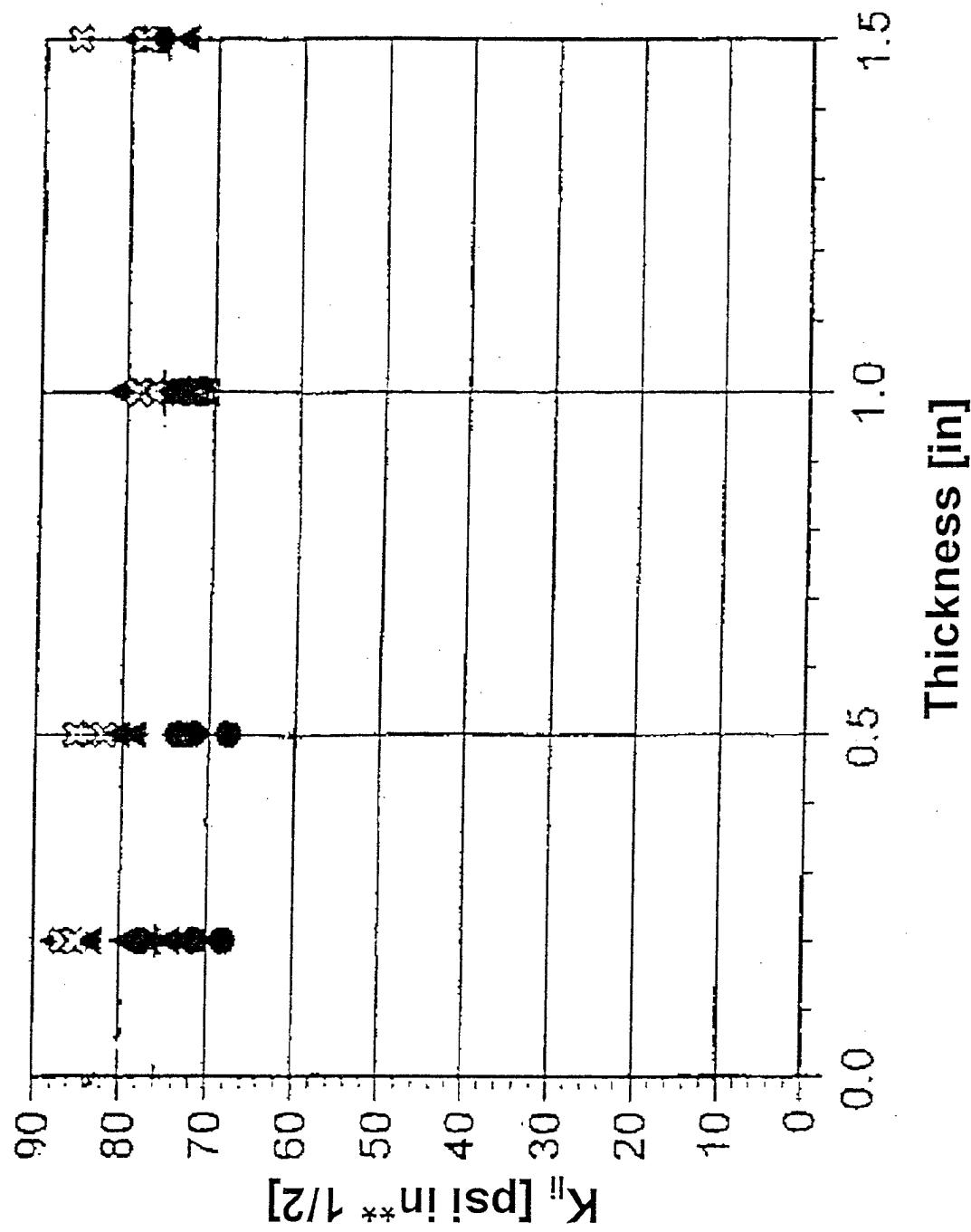
Strain [ % ]

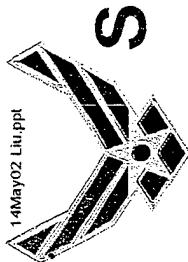




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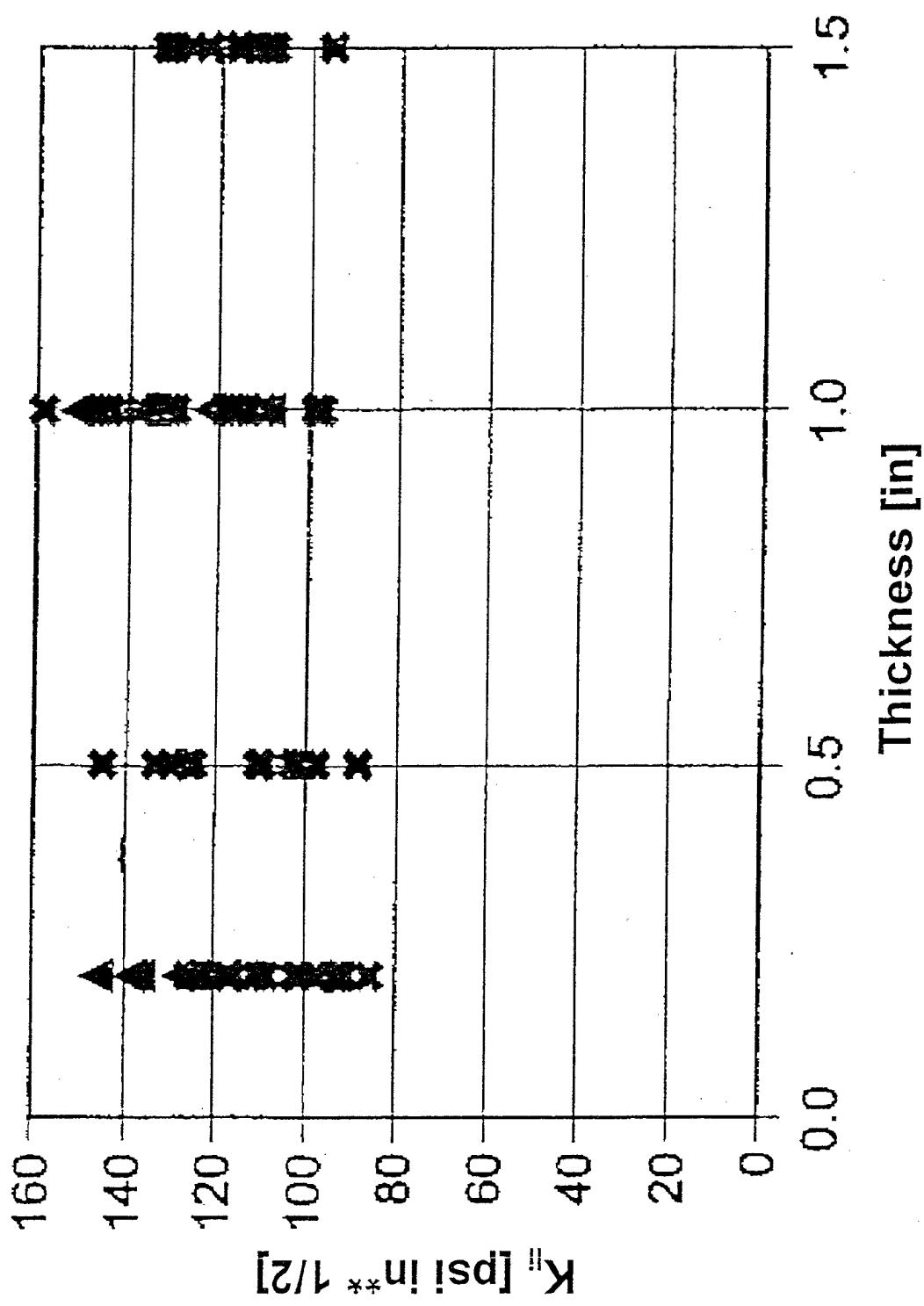
# Mode I Stress Intensity Factor vs. Specimen Thickness. (Ambient Pressure)



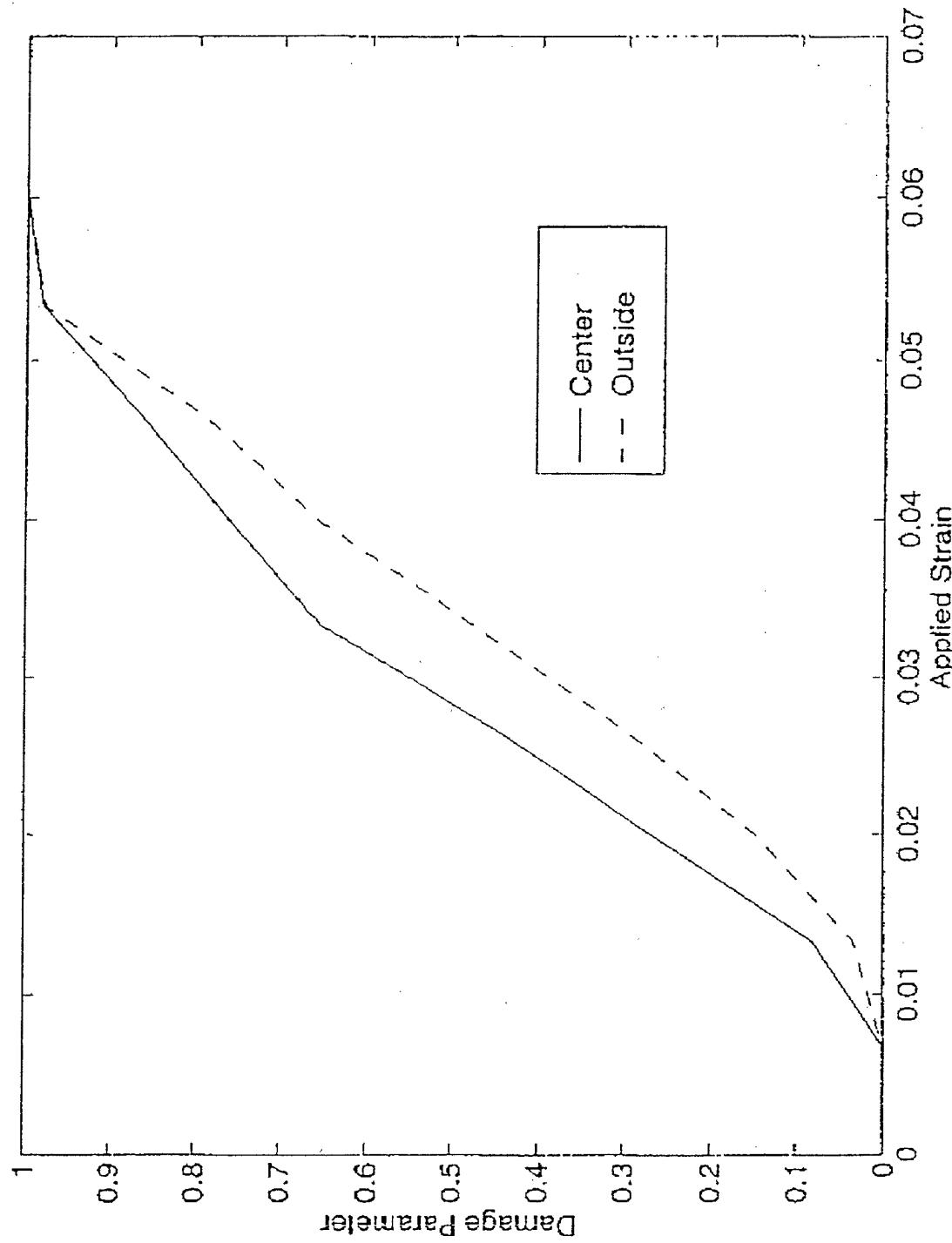
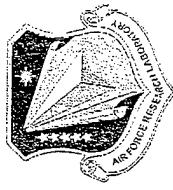


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## Mode I Stress Intensity Factor vs. Specimen Thickness. (1000 psi Pressure)

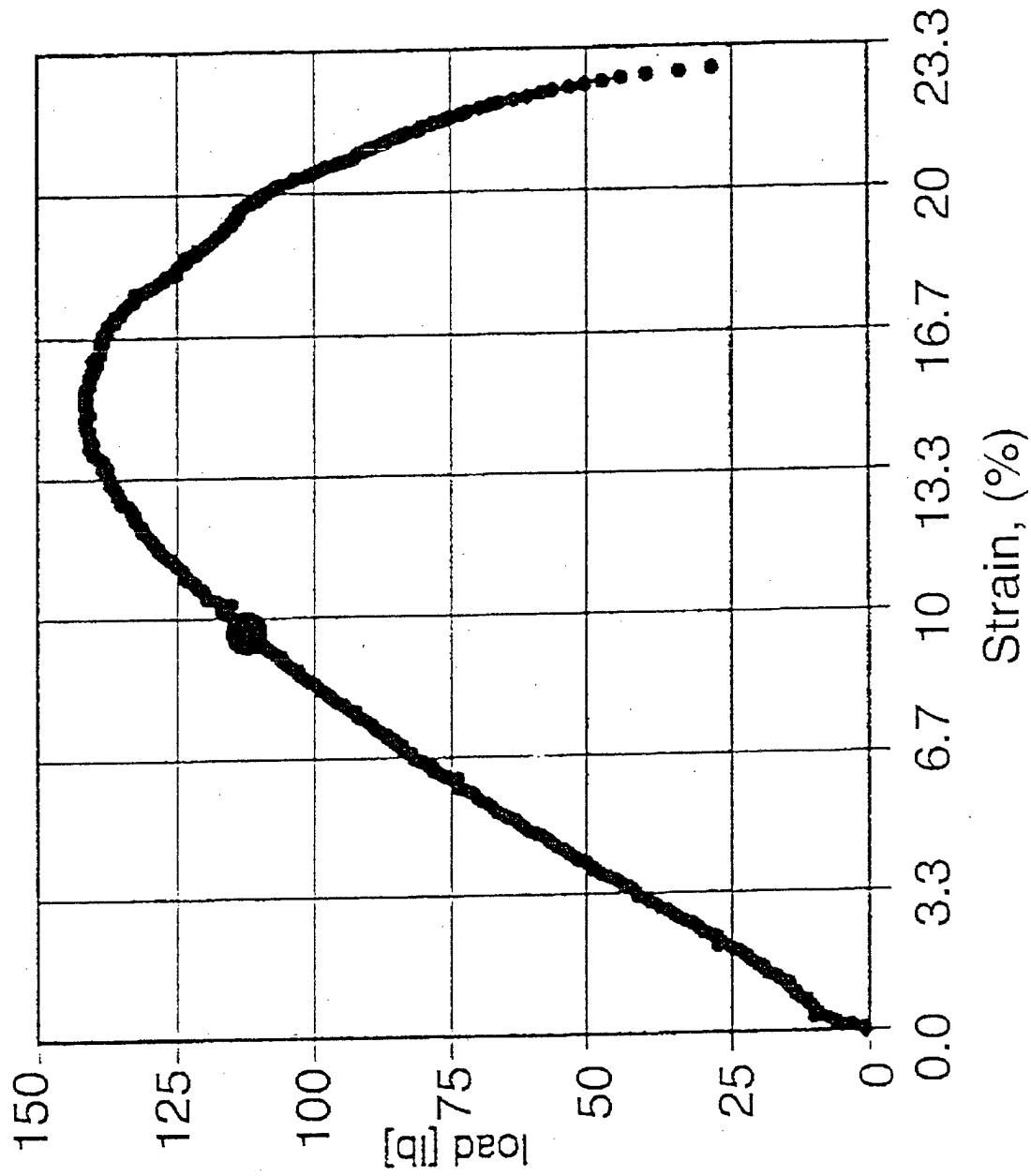


# Damage Distribution near the Center and the Surface of the Specimen



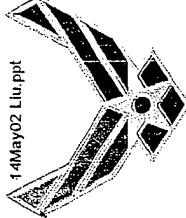


# Stress-Strain Curve under 1000 psi Pressure

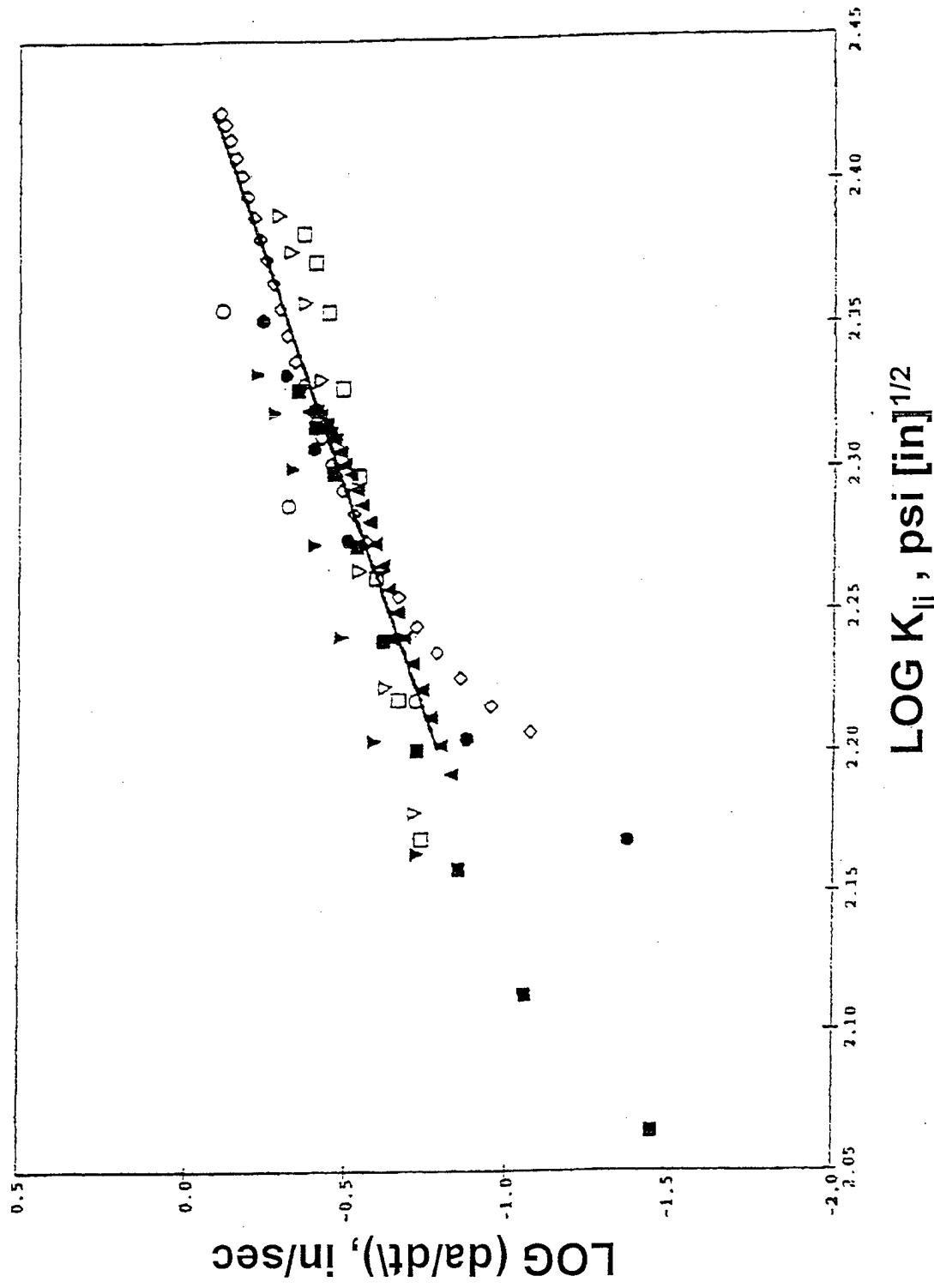


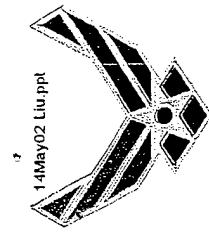


# Crack Growth Rate vs. Mode I Stress Intensity Factor



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## Conclusions

1. The critical Mode I stress intensity factor,  $K_{Ic}$ , for the onset of crack growth is insensitive to the specimen's thickness.
2. Plane strain fracture toughness does not exist for this material.
3. Brittle fracture occurs under ambient pressure, whereas a considerable amount of stable crack growth occurs under 1000 psi confined pressure.
4. A power law relationship exists between the crack growth rate and the Mode I stress intensity factor.



# Objectives

- Investigate the Effects of Specimen Thickness and Confined Pressure on the Crack Growth Behavior of a Particulate Composite.
- Specimen Thickness (in.): 0.2, 0.5, 1.0, 1.5.
- Confined Pressure (psi): Ambient, 1000.



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